

Atomic Structure Notes

Introduction

- ◆ History behind atomic models & parts
- ◆ Discoveries that helped in the discovery
- ◆ The parts of the atom
- ◆ Models of the Atom

Atomism

- ◆ Somewhere about 400 B.C., two Greek philosophers came up with the idea of the atom.
- ◆ They were _____

(known here after as the two dead Greek dudes).

- ◆ Their theory has five statements:

1. All matter is _____

2. There is _____ between atoms.

3. Atoms are _____ (no space within the atom).

4. Atoms are homogeneous, with _____

5. Atoms are different in _____

_____ (added by Epicurus later).

- ◆ Summary:

All did not embrace this idea.

Aristotle and others wrote against this idea.

The early Catholic Church also did not like this theory.

So it kind of disappeared.

Atomic Theory

- ◆ The Father of the Chemical Atomic Theory: _____

- ◆ Four basic ideas in Dalton's chemical atomic theory

1) Chemical elements are _____

- 2) The atoms of an element are _____
- 3) Atoms of different elements have _____
- 4) Atoms only combine in _____

such as 1: 1, 1:2,2:3 and so on.

This law is sometimes called the *Law of Constant Composition*.

In a modern textbook, it is:

A given chemical compound always contains _____

A different way to say it: _____

Dalton discovered the _____, a law that is easily explained by his atomic theory.

Dalton discovered this law while studying some of the oxides of nitrogen.

The law, in modern terminology, is:

Atoms of the same element can _____

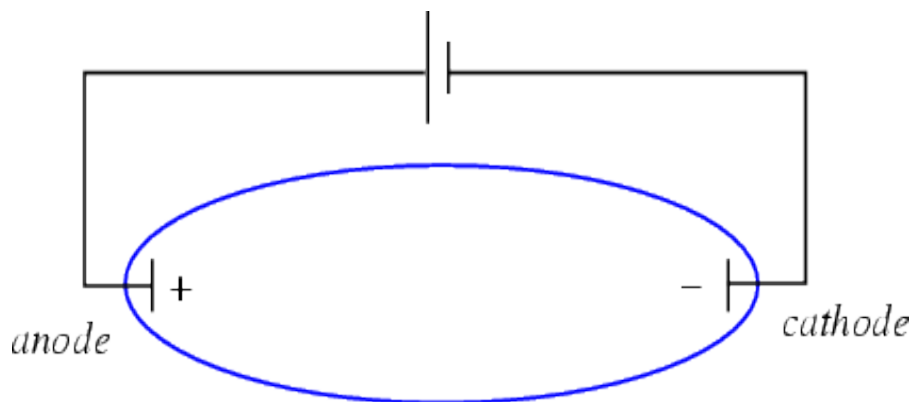
An element's atoms do not change into other element's atoms _____

– Examples: CO and CO₂ H₂O and H₂O₂

As it turns out atoms do have parts called subatomic particles. In the late 19th century, scientists set out to find out what makes up an atom.

Other important discoveries

Somewhere about 1880, a guy named Crookes developed a tube w/ metal pieces inside and all of the air sucked out. When electricity was applied to the tube a “beam” appeared. The beam traveled from the negative end to the positive end.



The Electron

1897- J.J. Thomson

His experiments prompted him to make a bold proposal: these mysterious rays_____

They are in fact_____

The rays are made up of_____: very small, negatively charged particles that are indeed fundamental parts of every atom.

◆1911- R. A. Millikan directly determined the _____

Once the charge was known, the mass could be calculated.

The electron is assigned the charge _____

◆The mass turned out to be _____

If all atoms contain negatively charged electrons, which contribute almost nothing to the mass of the atom, then where is the positive charge needed to make the atom have an overall neutral charge? And the mass?

The Nucleus

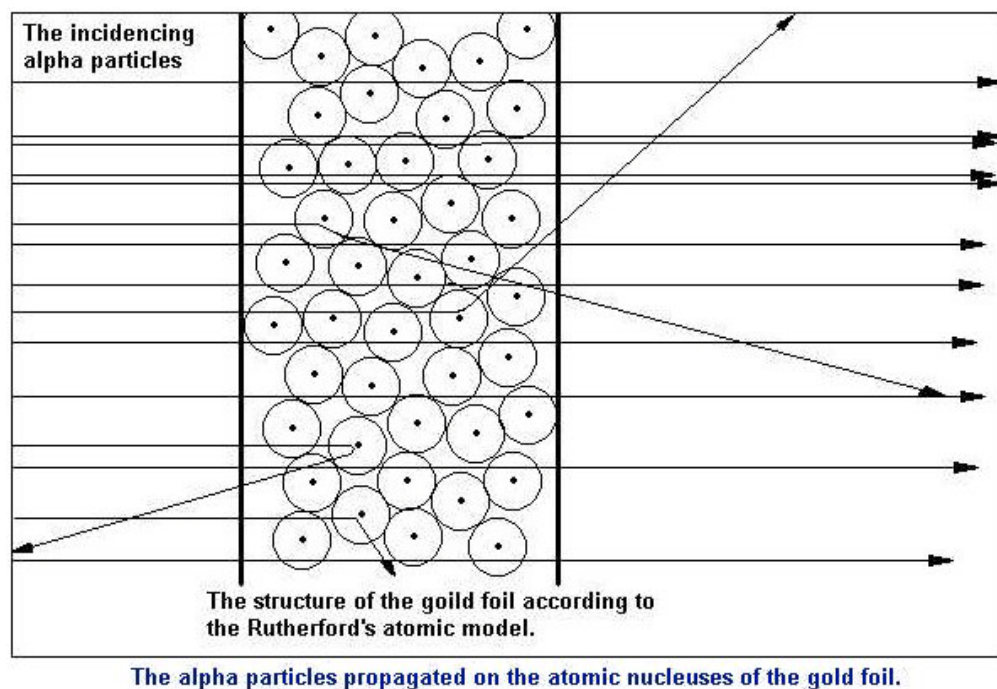
- ◆ 1911- Ernest Rutherford found that the atom has _____ later determines the nucleus to have a _____

Rutherford's Gold Foil Experiment

The experiment:

Alpha particles were fired _____

Alpha particles are helium atoms _____



The Results:

Most of the alpha particles went _____

Some of the alpha particles were _____

Some like 1 or 2 in several thousand _____

Rutherford's conclusions:

Atoms _____

The center (nucleus) is _____

The nucleus has _____

More on the Nucleus.

Henry Moseley (1913-14)

He discovered a mathematical relationship that calculated the _____
_____ (the "serial number" in the periodic table).

Also calculated the _____

Atomic number and Protons

This must mean that the atomic number is _____

Therefore, the atomic number is _____

Moseley was killed in action at Gallipoli in the First World War.

The neutron

Scientists now had two parts of the atom but they could not account for the mass.

Rutherford had predicted its existence but had no laboratory proof of its existence.

◆ 1932- James Chadwick discovers the neutron.

Bombarded small atoms (Be) with alpha particles and observed _____
_____ which were particles similar in mass to protons but had no _____

Hence the neutron (1st named in 1921 by William Harkins)

Atomic Structure: Atoms

- ◆ Atoms are made of _____
- ◆ The protons and neutrons are held together in _____

- ◆ The nucleus is _____

- ◆ The nucleus contains 99.9 % of _____
- ◆ The electrons are somewhere around the _____

- ◆ The size of the atom is _____

Particle	Symbol	Charge	Mass	Location	AMU
Proton	p^+	+1	1.673×10^{-24} g	Nucleus	1
Neutron	n^0	0	1.675×10^{-24} g	Nucleus	1
Electron	e^-	-1	9.109×10^{-28} g	Electron cloud	0

Atoms are not all the same.

- As knowledge of the atoms and elements grew, it became apparent that not all atoms particular element had the same_____
- Some seemed to be _____than others and some seemed to be _____than some.
- They did have the same _____
- atoms of an element with different masses are called_____
- The difference in masses is due to a differing number of _____ in the nucleus of the atom.

Isotope	# protons	# neutrons	# electrons
C-12	6	6	6
C-13	6	7	6
C-14	6	8	6
H-1	1	0	1
H-2	1	1	1
H-3	1	2	1

- See your element list sheet for correct isotopic symbol notation.
- Examples: Ne-22, C-12, C-13

Atomic Rules

- The number of protons in the nucleus of an atom is equal to the **atomic number (Z)**.
- In a *neutral atom*, the number of electrons is equal to the number of protons.
- The **mass number (M)** of an atom is equal to the sum of the number of protons and neutrons in the nucleus.
- The number of neutrons is equal to the difference between the mass number (M) and the atomic number (Z).

Models of the Atom

Greek Model

■ 400 B.C. (or somewhere about that time)

Greeks- _____

Dalton's Atomic Model

early 1800's, John Dalton

1. That all matter was composed _____

2. That atoms were _____

3. Consequently, his model explained that atoms were smaller spheres.

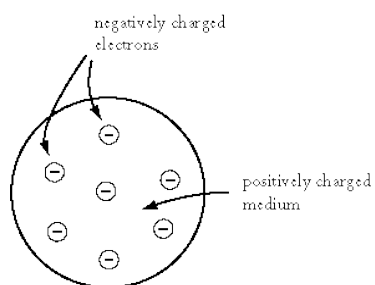
4. Atoms go together in _____

Thomson's Atomic Model

1. Showed how he thought electrons were arranged.

2. Showed that _____

■ Model of the atom looks like _____



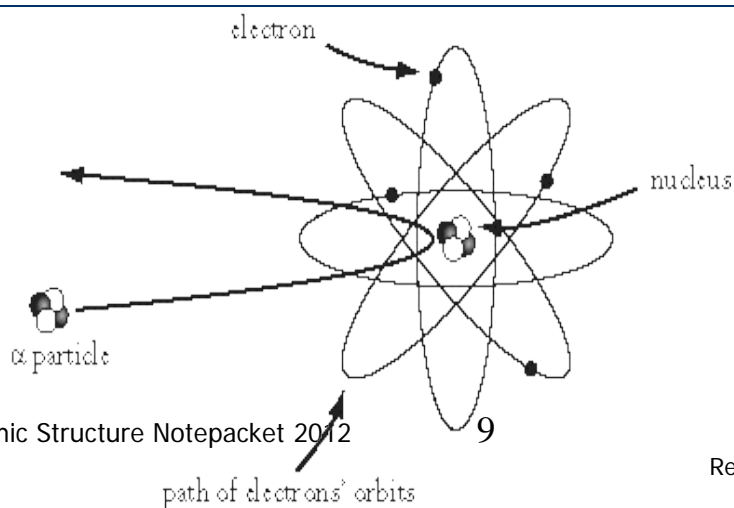
Rutherford's Atomic Model

■ This model suggested that most of the mass of the atom _____

■ Called _____

■ That the rest of the _____

■ Describes an atom as _____



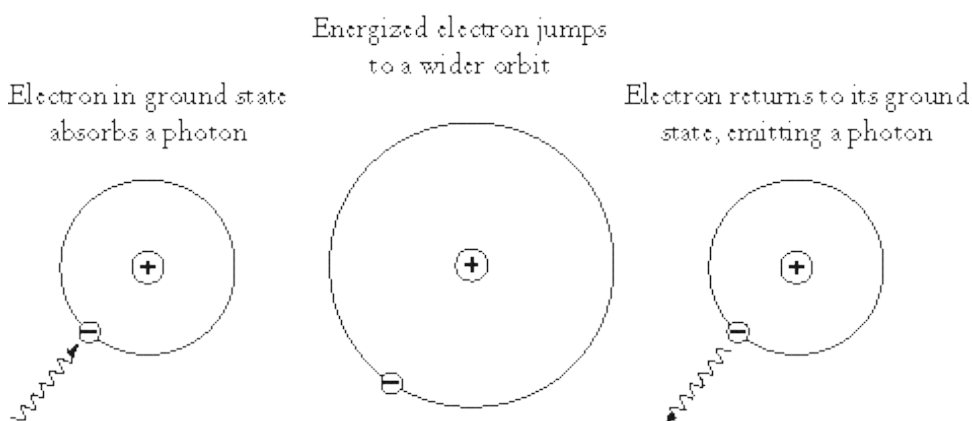
Bohr's Atomic Model

1. explained that an atom _____

2. This model suggested that the electrons _____

3. Looked like a _____

Bohr's Model



Quantum Mechanical Model of the Atom

1. fundamental ideas of _____
2. electrons do not actually _____
3. the exact location of an electron in an atom _____
only the _____
4. present day model describes an atom as _____

5. electron orbitals represent _____

6. location of an electron depends _____

Electrons are arranged in energy levels within a given electron cloud _____

such that the electrons with the lowest energy _____

and the electron with the highest energy _____

